

SCIENTIFIC NOTE

NOTES ON WINTER ROOSTING BY MONARCHS (LEPIDOPTERA:  
DANAIDAE) AT AN INLAND SITE IN CALIFORNIA

In 1942 Downes (Trans. Roy. Ent. Soc. London, 92(I):160) summarized the known wintering sites of the Monarch butterfly, *Danaus plexippus* L., on the California coast. The farthest inland that overwintering was reported was 25 km in Contra Costa Co. Although numerous later papers dealing with Monarch migration and overwintering have appeared, we have found no published record of sites farther inland. Since 1974, however, we have observed successful overwintering each year at Fairfield, Solano Co., 62 km from the coast. The climate at Fairfield is intermediate between those of coastal and inland valleys (Shapiro, 1974, J. Res. Lepid., 13:191-206). The roost is located in a row of large *Eucalyptus* trees running N-S on the west side of the city.

On November 6, 1976, after the migration had passed, fifty animals were found on the trees. We observed the roost at regular intervals through the winter. Even though we dealt with relatively small numbers, accurate counts of the butterflies were often impossible, due to the size of the trees and density of the foliage, and the visibility often confounded by dense fog common at that time of year.

On December 24 only three animals could be found alive. During the preceding week at least seven had been eaten, probably by a single bird which carried them to a nearby *Cotoneaster* bush under which their wings were found. Two weeks earlier, one of us (CMF) watched a Mockingbird (*Mimus polyglottos* L.) attempt unsuccessfully to catch two Monarchs in flight. Mockingbirds are common in the vicinity all winter. A few Monarchs were seen in Fairfield through January and February. On March 5, 1977 butterflies were again numerous at the site. We believe the March specimens represented an influx from the coast, since a Monarch was seen 170 km inland near Auburn, Placer Co. on March 19 (AMS).

Numbers roosting at Fairfield were lower in winter 1977/78. Remains of single predated individuals were found under the *Cotoneaster* on January 20 and February 3, 1978 and one wing directly under a roost tree on the latter date. On February 23 Monarchs were very common, again probably representing eastward migration from the coast; the first coastal specimen was seen in Davis, Yolo Co., 125 km inland, on March 12. Like Downes, we believe that the microtopography which attracts overwintering animals to individual groups of trees also attracts transients during both spring and fall migrations. Because of the gap in the Coast Ranges at the Carquinez Straits, large numbers of migrating Monarchs may be funneled through Fairfield.

CMF made observations on aggregating behavior during winter 1976/77. Groups of from 2 to 28 animals were found, normally on the lee side of the trees (generally east). On 3 calm days all the groups were on the west side, where the animals had been nectaring in the late afternoon sunshine. Arrivals trigger vigorous fluttering by animals already settled. This apparent aggregating stimulus also occurs in the dense coastal roosts; it is striking that systematic aggregation occurs even at densities 3–5 orders of magnitude lower than those seen at the coast.

Persistent communal roosting can be of only limited value against predators when such small groups are involved. If enough individuals are highly emetic, the value of clustering will be increased. Large aggregations are more likely to contain emetic butterflies, being recruited from a wider area in which a broader "palatability spectrum" (Pough et al., 1973, Proc. Nat. Acad. Sci. USA, 70:2261–2265) would be sampled. Large aggregations are also better able to saturate resident predators which are confined to restricted home ranges. The Mockingbird does maintain a winter territory (Hailman, 1960, Condor, 62:464–468). Thus, the very size of large roosts may reduce the chances that any individual Monarch will be eaten; small roosts would be far less effective.

Most Monarchs originating in the central Sacramento Valley, as well as the Fairfield area, have bred on *Asclepias fascicularis* Dcne., a relatively innocuous species, and are presumably palatable. Milkweeds growing in the surrounding foothills are more toxic-emetic (P. Tuskes, pers. comm.). We suspect that Monarchs which overwinter at Fairfield are mostly very late emergents from the last broods on the Valley floor and locally, and are therefore palatable. (*A. fascicularis* remains in usable condition into late autumn, whereas the foothill species usually do not, and we have seen larvae feeding at Fairfield and in the Valley into early November.) Migrants reaching Fairfield in September and October may spend a few days but do resume their coastward movement. For the last animals to arrive in autumn, spending the winter at Fairfield may represent a tradeoff between the risks of continued coastward migration and the risk of local predation. Fairfield is probably the farthest inland that a maritime climatic influence makes overwintering at all feasible. Normally, there is no overwintering at Davis. In the very exceptional warm winter of 1977/78 a few individual Monarchs among hundreds liberated in early December were able to survive (P. Cherubini, pers. comm.)—but there were no killing frosts in 1977/78 at Davis.

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